

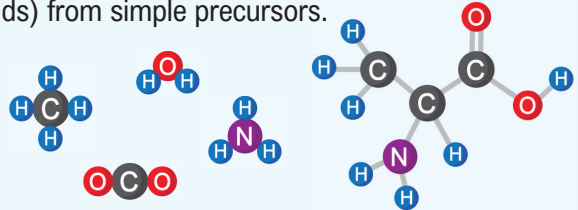
TOPIC: ORIGIN OF LIFE

Origin of Life

How do we get to things that natural selection can act on? → _____ steps.

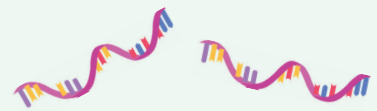
◆ _____ **synthesis**: organic molecules (e.g., _____ acids) from simple precursors.

- ▶ _____ hydrothermal vents or near volcanos.
- ▶ *Miller-Urey Experiment*: under appropriate conditions, _____ acids can form abiotically



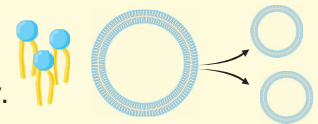
◆ _____ **molecules**: small molecules joined into larger molecules abiotically.

- ▶ _____ and amino acids polymerize in hot/drying sand or clay.



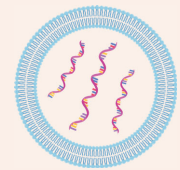
◆ **Protocell formation**: membrane-bound _____ can form spontaneously.

- ▶ Vesicles can contain macromolecules, _____, & have unique chemistry.



◆ **Self-replicating molecules**: _____ can act as a catalyst and store genetic information.

- ▶ Ribozymes: catalytic RNA.
- ▶ *RNA World*: hypothesis that early life was _____-based.



EXAMPLE

Scientists normally organize biological macromolecules into four groups: nucleic acids, proteins, carbohydrates, and lipids.

- Based on our current understanding of how life may have begun, which type of macromolecule would seem least essential to the first life forms? _____
- According to the RNA world hypothesis, which two types of macromolecules would seem the most essential?

- Some scientists argue that life arose “metabolism first”, where self-sustaining chemical reactions housed in protocells developed first, before the development of genetic material. If this hypothesis is correct, which type of biological macromolecule would be most essential to the development of life? _____

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PRACTICE

The Miller-Urey experiment showed that molecules like amino acids can form abiotically. However, the experiment has been criticized for using what are now believed to be incorrect environmental conditions. Scientists have since repeated the experiment using conditions that are thought to be more like the conditions where life first evolved and achieved the same results. What conditions did scientists likely try to replicate in the lab to model the abiotic synthesis of the first biological molecules?

- a) Neutral chemistry at the edges of melting glaciers.
- b) Alkaline hydrothermal vents in the ocean.
- c) Dry acidic conditions with abundant silica.
- d) Tidal pools with abundant lightning activity.

PRACTICE

The “RNA World” hypothesis is largely based on RNA’s ability to do what two specific things?

- a) Code genetic information and fold into three-dimensional structures.
- b) Provide structure for the cell and store genetic information.
- c) Form membranes and operate as part of the ribosome.
- d) Self-replicate and catalyze reactions.